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ABSTRACT

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BEYOND THE CURRICULUM:
CREATING THE CONDITIONS FOR LEARNING

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Abstract

Using current mind/brain research, this paper explores the "hidden curriculum" in the contexts of teaching, learning and supervision. It explains ways in which current research on the nature of learning can fit into today's typical, "clinical" teaching techniques. The importance of respecting individual modes of learning is stressed; further to this, a merger between creating the conditions for learning and learning itself is proposed. Supervisors and teachers who bring this research into their schools can further professionalize the jobs of educators. The paper is based upon findings in educational theory, psychology, mind/brain and neurological research; in most cases these research findings serve as foundations for actual classroom observations and findings made by the author over the past ten years.

Beyond the Curriculum:
Creating the Conditions for Learning

Eisner (1982) wrote, "Artistic approaches to [education] require attention to the muted or expressive characater of events, not simply to their incidence or literal meaning" (p.8). Peace of mind. Cooperation. Discovery. Much lies beyond the transcript of the class lesson.

Beyond Piaget

What are the conditions of learning? Through Piaget's eyes we can see that learning does not progress as a hiker up a slope. Rather, there are waves and troughs; there are periods of consolidation and sometimes frustrating stagnation, and there are breakthroughs.

What, then, brings about these periods of growth (whether cognitive, social, or other)? It is not physical maturity alone. For example, followers of Piaget's work, Ginsberg and Opper (1980), found that children in Martinique were reaching Piaget's "concrete operations stage" four years earlier than Swiss children (p. 208). It is only reasonable to assume that environment had some influence here. Piaget himself was able to isolate a wide variety of stimuli that promoted various types of learning at various ages. By analyzing the behavioral development of children, Piaget gave us a wealth of information about different learning styles characteristic of different ages. Piaget was able to accurately describe the specific levels of

cognition that normal minds are capable of as they grow. Indeed, an understanding of the preoperational, concrete operations, and formal operations stages are still invaluable to curiculum designers (Bruner, 1964).

Today's research on the workings of the mind and brain confirm Piaget's findings, but can take us way beyond them. Today's research is "looking in": we have not only to condition the environment to promote a receptive mind; we can condition the mind itself, directly, so that it will be more receptive and sensitive to the environment. We can condition the mind so that it will be more sensitive to itself.

Even 20 years ago Western educators would have had little use for such a statement. Beginning in the 1970's a large body of work, frequently in the name of mind/brain research or the human potential movement, began developing. This has changed the way educators think about learning. The research contains many promises and challenges to educators. During this same time period, bureaucracy and increasing accountability have made the teacher's day more crowded, leaving less time to keep current in educational theory. Hence, the jobs of teacher and curriculum designer have grown further apart. The task of bridging theory with actual pedogogy falls ever more firmly into the hands of the instructional supervisor. This paper attempts to show how this bridge might be built: how the most recent educational research translates into the classroom.

Part I. Teacher Centered Applications

The Anticipatory Set, Redefined

Mind/brain research has produced a new vocabulary: hemispherosity, modalities, psychobiology, neurochemistry, cybernetics. However complicated they sound, they are all little more than labels to describe what educators have known all along, but have had little technical understanding of: that there are vast unused potentials in every human mind. To tap these is the greatest challenge of education and should be a primary goal of every teacher, every day.

Reverence for these potentials is rapidly transforming the roles of classroom teachers and curriculum planners. Increasingly the emphasis of teaching is less on the traditional conveyance of information and more on creating conditions for learning. With the abundance of modern curriculum materials, arranging the content of instruction will become subordinate to the task of creating the conditions for learning. The emerging job of the teacher is simply to create the right atmosphere and arrange the right resources.

We can pinpoint this change within the context of a typical "clinical teaching" model of a class lesson, such as is followed by more and more California teachers. This model, developed by Goldhammer, Hunter, and others (Foster, 1985), generally consists of:

1) Anticipatory set, which involves setting the learning environment and introducing the lesson

2) Instruction towards the lesson's objectives

3) Guided (whole group) practice

4) Closure (summaries and conclusions)

5) Independent practice, with reteaching as needed.

This model is becoming like eyes to many supervisors, who may be required to analyze lessons using it. It is a very dangerous model because it tends to define learning, even limit learning, to whatever objectives the teacher has decided upon at the moment (unless the lesson objective is "discovery"). In other words, reaching measurable objectives has become more valued than the process of learning itself. This approach has the potential to stifle more learning than it promotes. So it is important that the clinical teaching model not be applied coldly, but with philosophy and perspective. Current research affords us a look beyond today's typical lesson plans and teaching units and can provide such a perspective.

Within the above model, the second through fifth points have traditionally been thought of as the "real" lesson. Needless to say, traditions die hard. What mind/brain research shows is that full attention to the first point accelerates the entire learning process very rapidly; and without it, teachers might as well be talking to the wind. The anticipatory set--"setting the learning environment"--does not end with a cursory introduction to the class lesson ahead; it must be sustained, always with the goal of keeping the doors to awareness open. Learning, and the love of learning, flower from this. As will be shown below, the applications of this revelation are great. Probably greater than Maria Montessori envisioned when she made essentially the same

point.(Hainstock, 1968) As William James saw, always there lie potential forms of consciousness entirely different from our own. (Ferguson, 1982) The changes will come when teachers realize that types of thought not available to them in the past are becoming viable.

The Hidden Curriculum

Perhaps the idea of hidden curriculum was initiated when the Romans sprayed a mist of wine into the air above the Colosseum. In the past ten or fifteen years interest in both therapeutic and educational benefits of altered states of consciousness has grown rapidly. Applying this, and related mind/brain research, a wide variety of previously ignored techniques for creating the conditions of learning, even accelerating the process of learning itself, are moving closer to the mainstream of mass education.

What are some of these techniques? The first might be called environmental. Teachers can now use research on the effects of sight and sound on the mind to construct improved learning environments. Even small changes, such as blue walls and a tape playing the sound of ocean waves, or "meditative" music, have been shown to alter concentration, memory and learning anxiety levels constructively. (Ferguson, 1979)

A second technique stems from what Goldhammer (1969), called "incidental learning." As he described it,

> In addition to the learning outcomes sought deliberately by the teacher, the pupils, individually and collectively, learn a great spectrum of things that the teacher did not intend them to learn, generally without the teacher's

awareness that they have been learned, and as a direct result of the teacher's behavior and of the pupil's tendencies toward learning in certain categories. (p.12).

The question is, can teachers gain control over this great body of incidental learning? What are the techniques?

How a teacher behaves, i.e., "facial expressions," "body movements," "vocal tones," etc. determine a large degree of what pupils perceive. (Wiles & Bondi, 1980, p. 227)

Everything the teacher does or does not do in the classroom has an impact on the atmosphere and the learning taking place. Mehrabian showed that facial expression conveys over 55 percent of the meaning of a supposedly verbal message. These nonverbal messages are more likely to be honest, as well, since they are often involuntary reactions of the autononomic nervous system. (Gazda, 1984, p.32) Such "nonverbal communication" is a large part of the incidental or "hidden" curriculum. Techniques for controlling this are rapidly becoming better understood. For their tremendous potentials, they should be in the training of all educators.

Today it may seem a large task--preposterous to some--to ask teachers to gain control over the subliminal; but we know it is possible and that it can have a giant effect on the learning process. First, teachers can begin controlling some of their nonverbal behaviors by becoming consciously aware of them. Picture a teacher shaking his head, clenching his fist, body turned to the side and eyes drilling down and to the left. He will not easily gain anyone's confidence. This may be fine,

provided only that this teacher is aware of the signal he is sending. (Gazda, 1984) Supervisors have a key role here since they are often in the best position to reflect teachers's own behaviors back at them. In giving feedback from classsroom observations, supervisors would do well to look for these often disregarded, outside-the-transcript behaviors.

Another area, psycho-linguistics, can teach educators how to use their voices (e.g., timing, tone, volume) for greater control. The voice trained in "subcortical linguistics" can reach the subconscious mind and guide it into a receptive state. (Masters & Houston, 1972 p. 239-240) Hypnotists have understood this for a long time, but its potential for teachers is only now coming out.

Gauging Thought

How can educators know when the desired level of concentration, awareness or understanding is reached by students? Goldhammer (1969) has shown that many who believe they know instinctively, don't. (pp. 40-41)

Defining the conditions for learning or, more specifically, defining the level of perception, has become a far more scientific endeavor over the past few years. Awareness level is being related to various specific biological and chemical measurements, which may or may not be available in classrooms of the future. Computerized brain scans called Positron Emission Tomography (PET) are helping to pinpoint which brain regions are activated when we see, hear, smell, touch, think and hallucinate.

Soon the brain activity associated with emotional states, learning and remembering may also be observable and measurable.(Ferguson, 1981) Such information is often called biofeedback and will be discussed further below.

Many researchers have found that the state of mind characterized by concentration and depth of thought is accompanied by the display of alpha (slower, higher amplitude) waves, said to be around seven herz, or of (still slower) theta waves, on an electro encephalogram (EEG). Some researchers have prescribed classroom recordings of ocean waves or certain Baroque music pieces, which match the frequency of these brain waves. Much of this work was pioneered by Prigogine (Ferguson, 1981) (discussed later), and will no doubt continue to unfold for years to come.

Similarly, Don found that insights or what he called "felt shifts" represent a higher-level reorganization in the brain, characterized by slower rhythms. (Ferguson, 1978, p.6) It is difficult to predict long-term educational applications of such work; but it has led to a burst of activity in the field of human relations, and given rise to a whole new field of understanding called neurolinguistics, or, giving and picking up subliminal cues through physiology and language.

Neurolinguistics is based upon techniques of several famous psychotherapists: Milton Erlickson, Virginia Satir, Gregory Bateson and Fritz Perls. (Huyghe, 1985, p.48) Critics claim that the techniques are or will be dangerously manipulative. But teachers may some day plan the desired state of mind as precisely

as the subject matter of a class.

The techniques are already gaining popularity. Harrison & Aschenbrenner, (1985) described a system which teachers may use to facilitate better communication, coined "Neuro-Linguistic Programming" by Bandler and Grinder. The system teaches educators to use interactive cues to more accurately understand the state of mind of learners.

The system is based upon patterns of student behavior as observed by Bandler and Grinder (Harrison & Aschenbrenner, 1985), whose work began in the early 70's in California, as well as on the pioneering work of Virginia Satir.(Huyghe, 1985)

Although the techniques require some training, with some introduction practioners can discover much of it for themselves. A brief description of the system follows.

Using eye movements and "predicates of speech" (for example, noting the use of phrases such as "I see that..." as opposed to ones like "I feel that...") a student can, with relative ease, be classified as having a predominantly visual, auditory or kinestetic learning style. Knowing this, the teacher can mirror, or "pace" the learner's own words, posture, and sensory orientation in order to more effectively establish rapport.

This ability to sense how accurately students perceive what one, as a teacher, is conveying has been called "sensory accuity", (Harrison and Aschenbrenner, 1985) and clearly weighs heavily upon effective communication. Misconceptions of the students' real motivations, "predispostions and intellectual behaviors" (Goldhammer, 1969, pp. 22-24) can be avoided by

learning simple pacing techniques.

As sensory accuity is improved, practitioners may learn to sense and to send out increasingly subtle cues. Tension in facial and neck muscles, eye pupil dialation, eye focus, and breathing shifts all can be used to enhance communication. A student could be paced and then lead into a visual frame of mind, such as is characteristic of good spellers and analytical thinkers; or he could be led into an auditory pattern, better for oral comprehension. (Harrison and Aschenbrenner, 1985)

Interestingly, today most mind research is concerned with the visual pattern of perception and communication, since this is stressed in the schools. Some researchers seem to be advocates of training students to better cope with this pattern; others believe that this pattern is discriminatory, favoring certain students at the expense of others, and they advocate basic changes in school instruction. In the view of this writer, the former is a more temporary way of coping with the larger problem: children aren't wrong, schools are.

The Autonomic Nervous System

One of the most amazing areas of research into consciousness and the mind is the study of the control of the autonomic nervous system. We can control parts of the mind that we're in the habit of ignoring. The autonomic nervous system ennervates the involuntary muscles--the diaphram, heart, gland cells, etc. It regulates digestion, eye muscles, reproductive systems, etc. It is the center of much of what we might call instinct, (Restak,

1979) a vastly important part of the mind which is largely ignored by schools.

One of the first clues we have that we can actually control this system, comes from the function of our breathing. Breathing can be totally conscious or totally unconscious; in one case, controlled by voluntary nerves, in the other, controlled by the autonomic system. For this reason some see it as a link between the conscious and the subconscious. It is no surprise that eastern texts teaching meditation offer the control of breathing as one of the keys. (Many Westerners are currently being taught to use breathing to control blood pressure and "stress" related conditions, but there are many more applications.) Meditation and hypnosis show us that the autonomic nervous system is not always involuntary at all, and there are an abundance of cases in point.(Weil, 1972) Consider:

> -an expert at yoga suspending respiration for a long time
> -a woman undergoing a caesarian section operation without medication
> (p.98)
> -a Minnesota psychologist causing his heart to beat to rhythms (he can do jazz, rock, country and western, or a metronome anywhere from 60 to 140 beats per minute) (Ferguson, 1983)
> -a subject in a strong hypnotic trance is touched by a finger and told that it is a piece of burning hot metal; a blister develops on that spot.(Weil, 1972, p.98)

In these instances a channel between the conscious (i.e.,

where the cortex acquires intellectual information) and the unconscious (or, autonomic nervous system) is open. It seems likely that hypnosis can improve a variety of subconscious functions such as memory. Does this mean it belongs in the classroom?

Physiological psychologists are taught to measure all sorts of mental and autonomous nervous system responses (doing scientifically what teachers and supervisors attempt to do intellectually and instinctively) to size up mental activity. Using biofeedback techniques, they can measure not only mental activity, but train people to monitor and to control their states of mind. The applications of control of the autonomic nervous system are so vast it is hard to describe limits to them. The use of biofeedback techniques may enable western researchers to bypass all the years of research that yogis have. Educational technologists and researchers may perhaps realize some of the almost unbelievable mental and physical feats once accomplished only by individuals considered to have extraordinary and inexplicable mental controls.

Mind/brain research has been useful not only in opening up new possibilities of the mind, but in better understanding old ones. For example, consider one resource that is probably more taken for granted and at the same time has more potential for educators than any other. It aligns all the neurons and sets off a release of endorphins, shifting the mind into an "active design process" (DeBono, 1985, p 75-76, 116-120). It consistantly produces quantum leaps in the state of mind: laughter. Aside

from the positive frame of mind it produces, humor brings about the clearest distinction between truth and dreams, something our educated society still has chronic problems in doing.

The potential of the mind is always beyond comprehension. As Watson put it, "If the brain were so simple we could understand it, we would be so simple we wouldn't" (Ferguson, 1982, p.168).

Part II. Child Centered Applications

The Problems of Today ...

The control of the conditions of learning is the most important step towards one of the primary educational initiatives of California schools in 1985: the teaching of "higher level" thinking skills.

> Hart described modern schools as "brain antagonistic:" "We are obsessed by logic, usually meaning ...tight, step-by-step, ordered, sequential (linear) effort ...But the human brain has little use of logic of this kind" (Ferguson, 1982, pp.324-325).

The brain's calculations do not require conscious effort. Too often children learn to trace ideas from point to point, like electrical wiring. Said DeBono (1985) "The purpose of thinking is to scan, to get a broader perceptual map and then to apply your emotions to it." Hence, at the heart of learning is invention and creation. This is not in fact a goal of very many schools. On the higher education level, as DeBono (1985) said,

"Much academic thinking could be carried out by a computer programmed to do library searches" (p120).

Findings on elementary and secondary education are similar. For example, Bloom, using his famous Taxonomy, categorized classroom questions from lowest (rote memory, restating, etc.) to highest (creative, evaluative) cognitive levels. He found, first, that questioning by the majority of teachers fell in the lowest levels and, second, that even small increases in divergent, non-linear logic inherent in the questioning led to major increases in awareness and divergent ideas produced by students. (Wiles and Bondi, 1980, p.222-224)

New Learning: The Techniques are Available

"The nation requires people who think for a living," said Thompson, (1985) President of the (United States) National Association of Secondary School Principals.

Materials specific to the development of various thinking skills are changing the emphasis of school curriculi. Schools formerly preoccupied with content--"make-believe disciplines" that Goldhammer (1969) called "caricatures of knowledge" (p.25)--now understand that they can enhance children's ability in a diversity of mental functions. Once this ability is raised, the content comes with far less effort. And perhaps more importantly, it comes with a much closer relationship to personal incentive and intuition.

Catalogs of Midwest Publications (Michigan), The Learning Company (California), Resources for the Gifted (Arizona), are increasingly popular examples of materials designed to exercise a

wide variety of mental skills which might be arbitrarily cut out of a highly content oriented curriculum. LOGO, an interactive computer program, is an example of how inventive thought can be taught in a structured way. (Papert, 1980)

Autogenic training techniques, long thought outside the realm of education, are moving into classrooms. They are teaching students how they themselves think and perceive. For example, visualization exercises are used to build sensitivity, relaxation, imagination, and concentration, as well as the powers of intuition. These exercises consist of guided imagery and concentration drills once confined to the practice of yoga and meditation. Visualization ability has been shown to have one of the strongest links to development of intellegence and the generation of thought. (Galyean, 1984)

The basis for this type of training was described by Prigogine (Ferguson, 1982, p.176-83) in this way: Memnonic and perceptual styles are patterns stored in the brain. Large fluctuations of energy, such as are produced by guided imagery, meditation, hypnosis, and psychoacative drugs, can send "ripples throughout the system, creating sudden new connections." The old pattern is broken. More simply put, visualization training offers students direct practice in imagining and clarity of thought. The result can be improved concentration, sensitivity to "intuitive flashes," or even (with enough practice) relief from lifelong learning and perceptual disabilities. (p183)

Two Current Trends

Moving into the center stage of research today is the type

of intelligence known as intuition. In arriving at decisions, conclusions, or solutions, the mind examines a large quantity of information. Often it does this in ways we are barely conscious of. This is intuition.

Intuition has often been thought of as some mysterious, psychic phenomenon. It has been treated in folk tales everywhere, but not science books. We know now that intuition is not magic, but simply "the accumulation of millions--perhaps even billions or trillions--of tiny, bits of information that are stored in the recesses of our memories and come together in an appropriate combination when the situation calls for it" (Grosswirth, p.30). Studying and developing intuition is another way of bridging the conscious and the unconscious mind. It is changing the way educators see intelligence. As the understanding of intuition deepens, it will become the object of specific classroom training. Nutrition is another area destined for a larger role in the classroom. This is an area which is taking on new meanings for educators. Teachers of the future will study the relationships between various behaviors and the function of certain neurotransmitters in the brain. Of special interest today are seretonin and norepinephrine, which are found to affect alertness and levels of perception. Dietary precursors, that is, foods and vitimins which stimulate these substances, are steadily being identified by scientists. Teachers, who are in the best position to observe the learning and thinking styles of children, will need to help parents in the design of their children's diets in order to enhance growth and

achievement. In the past two years tests have shown choline and tryosine (Kagan, 1985) (available in a variety of vitimin tablets as well as certain foods) to have clear impact on important academicly oriented brain activities such as memory and alertness. Eat fish.

Curriculum Disability

Mind/brain research holds promises for special education students, whose special problems may have been created by school systems and not any dysfunctions of their own. Farnham-Diggery (1978), in describing the work of many researchers, has shown that right hemisphere dominance appears in males by the age of six. Females do not seem to have this dominance. What this means, put very generally, is that girls will recognize various shapes and forms earlier and with less chance of confusion than boys. Farnham-Diggery cited research that 85% of dyslexics are boys, and that dyslexia is more severe in boys. Further, she found that this dominance could actually be made to shift "as a function of learning sets induced by certain forms of school instruction"(p. 129). Much of the recent "thinking skills" material has been produced on this premise. It offers students a chance to develop a much broader spectrum of thinking styles, and so gives many students a chance to use strengths which might go ignored in a traditional (content- and not student-oriented) curriculum.

McCarthy (1983) stated that "the right brain is being slaughtered in the schools." Hers was not a lone voice, and a wide variety of hemisphere-sensitive curriculum materials have

appeared on the market in the past few years. A California Institute of Technology biomedical engineering specialist has even developed contact lenses for the purposes of screening out half of the visual field. More practical resources fit into existing school curriculi. Controlling involvement of the hemispheres should be made possible in the future by the development of autogenic training and other educational technology. (p.129 -135)

Elkind (1978) has theorized that such children are in truth "curriculum disabled." This theory charges the schools with changing their styles, not the children. (pp. 223-236) We frustrate many children by forcing them to sit in a fairly alien environment for the most part of ten to twelve years. As identification and understanding of various learning styles continues, teachers and curriculum planners may become accountable for specifically integrating them into daily lessons and to genuinely "honor learning styles" (Galyean, 1982).

Cycles of Learning

New discoveries about the cyclical nature of the brain, that is, its tendency to reach certain levels of ability at certain ages, (Restak, 1979) confirm much of Piaget's work. They attempt to understand the development of the mind and brain, in a way that parallels Piagetian development of behavior and intellect. They have the promise of making curriculum planning more efficient.

Seven- or eight year-old boys, for a more specific example, typically need to move around more than girls of this age and

certainly more than teachers of any age! Their predominant mode of learning typically involves doing and sensing, and they may have trouble with quiet reflection. Practically all kids labeled "learning disabled" or "hyperactive" in this age group are boys.

The Future

A Global Perspective

Before concluding, consideration needs to be given to a most basic question: supposing we can produce superior minds, what shall we do with them? Or, do we even need them?; will this make a better world?

Boyer (Scott-Blair, 1985), President of the Carnegie Foundation for the Advancement of Teaching, described today's United States college students as isolated. 25 percent of students surveyed found nothing in common with people of underdeveloped nations. 40 percent could not locate Iran or El Salvador on a world map.

Is this a reflection of bad history teaching? Of a need for another commission report? Certainly neither. It reflects a lack of future perspective and a lack of vision. It shows self-centeredness and small mindedness at a time when international understanding is becoming vital to world survival.

Boyer said,

Interdependence and understanding (involving people and nations) is so crucial to the world of today and tomorrow that young people don't understand that they are being educated toward ignorance, no matter how strong they are in the so-called basics"

(p.B1).

A school can provide a community which is linked on many levels to outside events and institutions; or it may be an isolated place where thoughtful but captive students must wonder, "Why am I doing this all day?" It can assume responsibility for progress (in its curriculum and in the actions of its leaders), or it may be so busy grinding its own wheels that it must reward its teachers just for coping.

Modern educational systems, by concentrating on bureaucratic accountability and mass production techniques, have been forced to move away from individualization, a sense of community even locally, and a feeling for ecology on all levels. In the United States, for example, this has often occurred at the mercy of very understandable government mandates, such as the equality of opportunity movement or the teacher accountability movement. However bold the banners under which such mandates are made, they serve to limit the freedoms of professional educators.

As a model, our educational institutions value organization and rote direction-following above warmth and open-mindedness. However understandable the reasons, the model exists. As Boyer (1985) explained, this model lies hidden from students and, often enough, teachers who know little of any other reality. As models do, it goes on teaching.

Today, thinking skills training, global perspectives and future studies are budding trends which are closely bound together. They are the ends and the means at once. Schools which assume more responsibility for the development of any of them will

promote inventiveness and open-mindedness, and will help bring about a flowering of all three.

Technology

New interactive technologies could enable computers to work with several children at once. Freeman and Mulkowsky (1979) described a robot that talks and tests peoples's ability to think, learn, create, and play games". These computers can be programmed with the interests and special needs of each of their users. (p.43) They could individualize instruction more efficiently than classroom teachers are able to by tapping into curriculum banks and student progress records. Interactive computer programs can quickly assess student skill levels and summon up appropriate drilling.

The meaning of intelligence is changing. World-wide data banks can link students to information instantly, and intelligence will increasingly be viewed as the ability to organize this flood of information, mix it with values, and apply it. Satellites will put educational institutions in touch with events and individuals world-wide.

This coming technology should not replace teachers. What it should do is free them up from the constraints of the overcrowded classroom and the drudge of clerical work. Much lies beyond the transcript of the schoolroom lesson: cooperation, peace of mind, discovery ...The teacher should be free to plan the development of the whole student and, with the partnership of supervisors (who are in the best position to transmit changing values and educational innovations into the school), to create the

conditions for learning.

Discovery

The writer can not know how every other teacher or supervisor will take this research, but only what to take from it personally: to be a secure enough educator to let go; to stop seeing motivation as "kids doing what I want them to do"; to respect the integrity of the mind of each student, no matter what age; to know that understanding is not knowing until it has mixed with the imagination--it is not passed like a baton; to value children's intuitions and instincts enough to give them the time and patience required; to value the integrity of the mind over and above spelling and times tables and the year 1066. All of these can be gleaned naturally and easily once the mind is ready for them. At this point technical virtuosity and the process of discovery will become different names on either side of the same door. The conditions for learning, the learning itself, and, hopefully, the reasons for learning will all merge. By the time this research gets old, students may have learned a thousand more skills from me, but they'll still have to invent the world on their own.

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